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(19)

(54) SYMMETRICAL BALANCED STRIPLINE DIPOLE

(71) We, THE BENDIX CORPORATION, a corporation organised and existing under the laws of the State of Delaware, United States of America, of Executive Offices, Bendix Centre, Southfield, Michigan, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to symmetrically balanced dipoles which are constructed in accordance with stripline techniques.

In the past stripline dipoles have been constructed wtih exposed feedlines. Dipole feedlines, generally in stripline, have been etched on the dielectric board, either on the same side with the dipole or on the opposite side. If on the same side, the feedline extends from the base of the dipole, where it is normally connected to the center conductor of a coaxial connector, between and parallel to the dipole legs and terminates at a physical connection to the root of one or the other of the dipole arms. If the feedline is disposed on the opposite side of the dielectric board from the dipole, it extends from the base of the dipole, where it is connected to the center conductor of a coaxial connector, to the root of the dipole arms and then folded back a quarter wavelength of the operating frequency to terminate in an open circuit. In addition, the feedline runs parallel to so as to overlie the dipole legs. In either of the above embodiments of stripline dipoles the feedline is exposed. It is well known in the art that currents existing on exposed dipole feedlines and feeding a center fed half wave dipole cause radiation from the feedline as well as from the dipole arms. The radiation patterns from these two radiators then combine to give an unexpected and usually undesirable resultant antenna pattern. In order to overcome these undesirable effects attempts have been made to shield the feedline on stripline dispoles by providing a sandwich having a dipole on each outside surface and the feedline sandwiched therebetween with an electrically conductive pin being driven through the supporting dielectric boards to contact and connect the feedline to the dipoles.

The present invention is a balanced and symmetrical dipole comprised of three layers of stripline disposed on a two layer sandwich construction. Specifically, one layer of the sandwich construction consists of a dielectric board having a stripline dipole disposed on one surface and a feedline in the form of a choke section overlying the dipole legs on the other surface. The second layer of the sandwich construction consists of a second dielectric board having a stripline dipole on one surface. The two dielectric boards are arranged back-to-back with the respective stripline dipoles on the outside of both layers ad the feedline comprising a third stripline layer in underlying relationship to the dipoles.

It is thus an object of this invention to provide a balanced stripline dipole.

In the drawings:

Fig. 1 is an exploded view of a device made in accordance with the principles of this invention.

Fig. 2 shows an embodiment of the invention including a feed connector and an extended dipole ground plane.

In the following description the same numeral refers to identical elements in the various figures.

Referring first to Fig. 1 there is seen an exploded view of a device made in accordance with the present invention. The device shown is comprised of two dielectric boards 10 and 12 which are suitably identical in that stripline dipoles are disposed on

one side of each but which differ in that a stripline feedline in the form of a microwave choke is disposed on an opposite side of one board. Specifically, a stripline dipole 14 is disposed on one side of board 10 and stripline dipole 16 is symmetrically disposed with respect to stripline dipole 14 on one side of board 12. Dipole 14 is comprised of arms 14a and 14b and legs 14c and 14d which connect the arms to ground plane 18. Similarly, dipole 16 is comprised of arms 16a and 16b and legs 16c and 16d which connect the arms to ground plane 20. This embodiment shows a half wavelength dipole, that is, each dipole arm is a quarter wavelength of the dipole operating frequency. It will be obvious as the description proceeds, however, that the invention can be used with other length dipoles.

As previously mentioned a stripline feedline 22 is disposed on the side of board 12 opposite from dipole 16. The feedline is comprised of a section 22b which extends from an end 22a which comprises the feedline terminal at the base of the board, from which end the dipoles are intended to be communicated with applicable circuits as will be explained below, to a point which overlies the root of dipole arm 16a. The feedline is then folded over via section 22c to a point overlying the root of dipole arm 16b and back via a quarter wave length section 22d to terminate at end 22e in an open circuit. Feedline sections 22b and 22d overlie dipole legs 16c and 16d respectively, and when board 10 is assembled to board 12, underlie dipole legs 14c and 14d, respectively. In other words, feedline 22 and the various dipole legs form what is analogous to a coaxial transmission line where the feedline is analogous to the center conductor and the dipole legs are analogous to the outer conductor.

Note that feedline 22 is not d.c. connected at any point to either stripline dipole. Electrical connections between the feedline and the dipoles is effected through the action of a quarter wavelength section 22d. Specifically, since quarter wavelength section 22d terminates at end 22e in an open circuit, a point a quarter wavelength back from the open circuit, at the point which overlies the roots of arms 16b, and 14b, is effectively short-circuited to the roots of those arms, thus inducing in those arms at the roots thereof the signals from feedline 22 if the dipole is a radiator, or conversely, inducing in feedline 22 the signals received by the dipoles if the dipole is a receiver.

Refer now to the assembled device of Fig. 2 which shows board 10 assembled to board 12 by means of suitable fasteners such as bolts 25. Dipole 14 is shown on the outside surface of board 10, while dipole 16 (not shown) is carried by the outside surface of board 12 and, of course, in register with dipole 14.

The device is also comprised of generally U-shaped members 30 and 32 assembled to boards 10 and 12, respectively, by bolts 25 so that arms of each member together form a ground plane 27, members 30 and 32 being of electrically conductive material and in intimate contact with stripline ground planes 18 and 20 (Fig. 1), respectively.

The device also suitably includes a coaxial connector 34 whose outer conductor is supported and held by members 30 and 32 and a flat tab-shaped inner conductor 34a which is sandwiched between boards 10 and 12 so as to be in intimate contact with end 22a of feedline 22. In Fig. 2 member 30 and board 10 are cut-away to show tab 34a. Also note that the feedline shown in Fig. 2 differs slightly from the feedline of Fig. 1 in that it is diverted at end 22a slightly to the right in Fig. 2 to permit connector 34 to be centred with respect to the dipoles. In Fig. 1, of course, a connector would be moved slightly to the left or the connector center conductor would be biased slightly to the left to contact end 22a if a centred connector is desired.

Having shown an embodiment of our invention and explained its theory of operation various modifications and alterations thereof should now be obvious to one skilled in the art. Accordingly, the invention is to be limited only by the true spirit and scope of the appended claims.

WHAT WE CLAIM IS:—

1. A symmetrical and balanced dipole device, characterized in that it comprises three stripline layers, with first and second layers being first and second stripline dipoles of essentially identical form and shape, having respectively first legs and connected first arms and second legs and connected second arms, overlying one another and in register with each other, the first and second legs of the first stripline dipole overlying and the first and second legs of the second stripline dipole underlying a feedline in the form of a microwave choke whereby the feedline is shielded by the stripline dipoles and separated from the dipoles by intervening dielectric layers.

2. A symmetrical and balanced dipole device as claimed in claim 1, in which the first stripline dipole is disposed on one side of a first dielectric board and the second stripline dipole is disposed on one side of a second dielectric board and said feedline is disposed on the other side of said second dielectric board overlying and in register with the first and second legs of the second stripline dipole, said first and second di-

electric boards comprising said dielectric layers.

3. A symmetrical and balanced dipole device as claimed in claim 2, in which said feedline has a quarter wavelength section at the end thereof and terminates in an open circuit, said quarter wavelength section being disposed between, parallel to and along said second legs from the open circuit at one end of said quarter wavelength section to a point overlying the roots of said second arms at the other end of said quarter wavelength section.

4. A symmetrical and balanced dipole device as claimed in claim 3, in which said feedline is a folded feedline which further includes a first section extending from a terminal end to a point overlying the roots of said first arms parallel to and overlying said first legs, and a second section extending from the point overlying the roots of said first arms to the point overlying the roots of said second arms and from which the quarter wavelength section extends to said open circuit.

5. A symmetrical and balanced dipole device constructed and adapted to operate substantially as herein described with reference to and as illustrated in the accompanying drawings.

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1 SHEET *This drawing is a reproduction of the Original on a reduced scale*

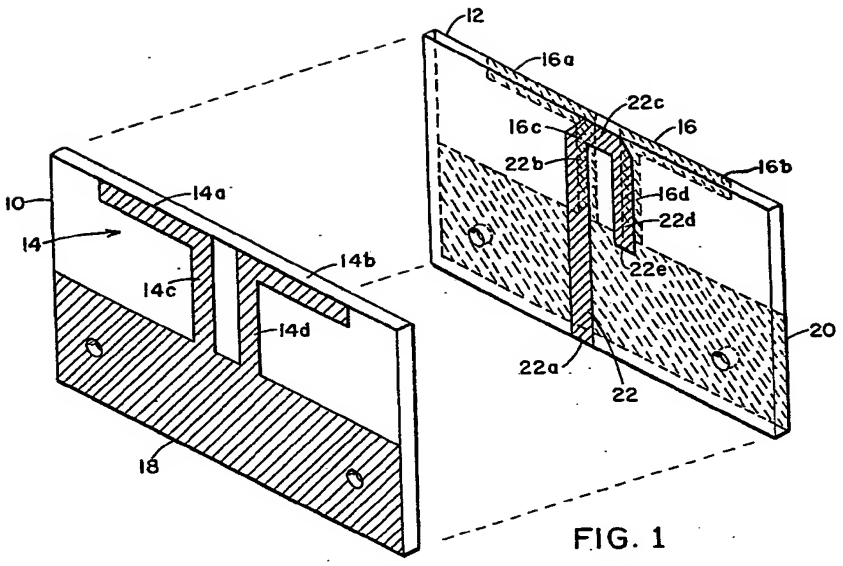

FIG. 1

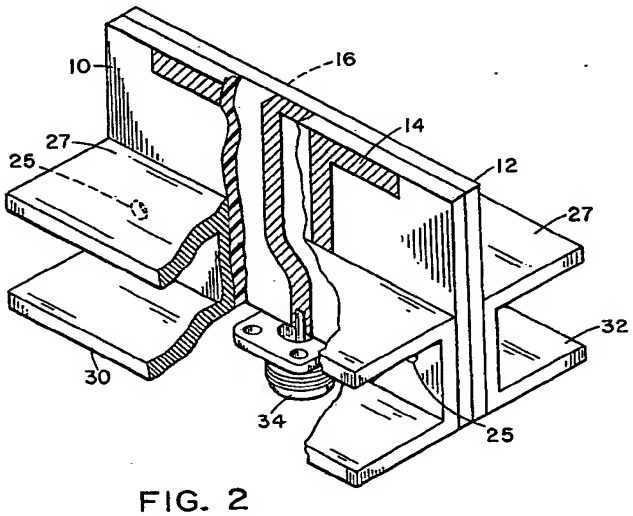

FIG. 2